Favored Angle Screw

Surgical Technique
Contents

Introduction 1
Screwdriver Application and Screw Placement 2
Segmental Translation 3
Segmental Derotation 8
Final Tightening 11
Additional Techniques and Uses 13
   Lumbar Leveling
   Proximal Overcontouring
   Pumphandle/Cantilever
Removal/Revision Instructions 16
Ordering Information 17
Introduction

DePuy Spine continues to support the goal of expanding the spine surgeon’s options for the treatment of spinal disorders. The EXPEDİUM® Favored Angle screw is an innovative solution for the correction of both complex deformity and degenerative pathologies. The Favored Angle screw design takes three proven pedicle screw technologies and combines them into one powerful implant, all while maintaining compatibility with the EXPEDİUM® Spine System. The uncompromising versatility of the EXPEDİUM® brand of products allows surgeons to select from a wealth of innovative technologies, such as the Favored Angle screw, and apply it to their individual technique for optimal correction.

This guide will provide step-by-step descriptions of segmental translation and derotation using the Favored Angle screw. Furthermore, this guide will address other commonly used techniques, which have proven successful with the innovative Favored Angle screw technology.

The EXPEDİUM® Brand of products once again redefines control of complex deformity and degenerative pathologies through innovative technology introductions.

The Favored Angle screw features a Dual Lead thread design, which allows the screw to advance twice as far per turn, when compared to standard screws.
Surgical Technique
Screwdriver Application and Screw Placement

Extended tab di quick-connect screwdriver application
- Place the tip of the screwdriver into the head of the screw. Slide the screwdriver sleeve down and thread into the reduction tabs and screw head. To disengage, unthread the screwdriver sleeve.

Screw Placement
- Use head adjuster to place head of screw in desired location (Figure 1).

Notes: The screw head should sit slightly above the posterior vertebral cortex to allow polyaxial movement and to receive the benefit of the favored angle. Alternatively, the pedicle broach (reamer) can be used to create additional space.

The notch/etch on the screw head indicating the orientation of the favored angle should be placed lateral to the pedicle to ensure the head can angulate away from the spinous process and allow translation reduction (Figure 2).

See Pedicle Targeting Technique, EXPEDİUM® Surgical Technique and Pedicle Screw Insertion Technique for details on pedicle targeting, preparation, and insertion.
Segmental Translation

Segmental Translation is a widely used maneuver for the correction of coronal deformity (Figure 3). The main goal of this technique is to segmentally bring the spine to the contoured rod, allowing for coronal correction to occur. The use of the EXPEDIUM® Favored Angle Screw at each level may minimize the potential for screw pull out during reduction maneuvers since the strain forces are spread over multiple levels. This maneuver can be performed in conjunction with other techniques to allow for sagittal, coronal and axial correction.

Figure 3
Contour the rods for both the concave and convex sides of the construct.

- Titanium and CoCr Alloy rods will require different amounts of force to achieve desired kyphosis or lordosis. Some degree of hyperkyphosis can be built into the concave rod to account for flexibility in the material and stiffness of the curve during the correction maneuver and may help to pull the lordotic apex of the concavity out of the chest. Conversely, the convex rod can be undercontoured to aid in reducing the rib hump and derotating the apex.

Insert the concave rod into the proximal and distal anchors. If rod has both kyphosis and lordosis, it may be possible to only insert into distal anchor to begin.

Insert the setscrews into the anchor points using the DI Inserter and tighten outer setscrew (purple color ring) to lock the trajectory of the screw shank and fix the position of the screw head.

Notes: The inner setscrew should not advance beyond the underside of the outer setscrew. This condition prevents:

- The outer setscrew from locking the poly head in place for correction maneuvers.
- Translation along the rod during compression and distraction maneuvers.
- The ability of the DI Inserter to properly engage with the setscrew.
After proximal and/or distal foundations are secured, the spine is translated to the rod segmentally by reducing the rod into the reduction tabs using the setscrews (Figure 4, 5, 6). Figure 6 illustrates segmental reduction. As each setscrew is reduced into the screw head, the Favored Angle in the adjacent level is brought closer to the rod.

Notes: The favored angled allows for an added 15° of lateral angulation of the screw head, which aids in capturing the rod at the apex of the curve.
Typically the sagittal contour of the rod is still in the coronal plane, although it is now fully captured. The rod may not be fully seated in the screw. A Cotrel Dubousset rod rotation maneuver can be performed at this point to correct the coronal deformity with appropriate sagittal contour.

- Rod holders can be used to rotate the rod, or alternatively, use of the hex wrench on the hex end of the rod along with the rod holders allows the rod to be rotated to restore sagittal alignment (Figure 7).

- In order to reduce the rib prominence, it may help to have an assistant push down on the convex ribs and the convex screws. The use of alignment guides assembled on the screw heads are used to rotate the vertebral bodies into proper axial alignment. This step may help to reduce the rib prominence.

- Additional alignment guides can be placed at the neutral vertebral segment of the construct to ensure opposing rotation is not introduced in the lumbar spine.
Additional correction, such as segmental derotation can be performed at this point (Figure 8).

- Insert second contoured rod on convex side.

- Lock rod into place using DI setscrew and final tighten all outer setscrews. The Dual Locking feature of the screw turns the polyaxial screw into a fixed angle screw when the outer portion of the set screw is fully tightened, aiding in derotation maneuvers.

*Notes: Coinciding multi-level rod capturing distributes load throughout the construct and reduces the risk of screw pullout during translation.*
Segmental Derotation

Segmental Derotation can be performed as the sole correction maneuver, or can be used in addition to other correction techniques. In cases where there is rotational deformity of the spine, axial correction may be needed, which can be addressed by this technique.

Implant the sagittally contoured concave rod and capture with setscrews. Most setscrews should be left loose since lengthening of the spine is expected at each level that will be segmentally derotated. Only the setscrews in the distal and proximal neutral vertebra should be tightened.

- Two rods can be implanted at this time, however Direct Vertebral Rotation (DVR) is most effective when done with only a single rod captured in the screw heads.

- Advance the purple outer portion of all setscrews to lock the head of the screws in the desired location. This will not lock the screw onto the rod, but rather provide for rotation of the screw around the rod for derotation, as well as compression and distraction (Figure 9 & 10).

Notes: The inner set screw should not be advanced beyond the underside of the outer setscrew. This condition prevents:

- The outer setscrew from locking the polyaxial head in place for correction maneuvers.

- Translation along the rod during compression and distraction maneuvers.

- The ability of the DI Inserter to properly engage with the setscrew.
Apply two Alignment Guides (Facilitator Tubes) to the distal anchors of the neutral segment. Place another two alignment guides on the next proximal level.

Derotate proximal vertebra to neutral and tighten setscrews.

Repeat previous steps, moving proximally toward the apex (Figure 11 & 12).
The long tabs allow loose approximation of the contralateral rod during this maneuver, and they allow DVR to be repeated several times during the correction without having to remove the rod.

Repeat at each level until vertebra match the neutral proximal and distal vertebra.

At the apex, Apical Derotation can be performed to achieve greater correction.

- In conjunction with DVR, the apical screws on the concave side can be locked, while the convex side rod is implanted.

- While reducing the rod using the reduction tabs, the concave pedicle screw will be brought up to the rod. While performing this maneuver, correction of axial rotation may be facilitated by pushing down on the convex side of the rib hump (Figure 13). This will both augment and maintain vertebral rotation.

- Multiple Alignment Guides (Facilitator Tubes) or Rotators can be used in an effort to distribute the rotational forces across multiple pedicles.

Compression or distraction can be performed segmentally at this point if needed, as the Favored Angle screws allow for parallel compression/distraction on the rod.

Gradual distraction from the lumbar levels to the thoracic levels on the concavity can aid in additional coronal correction. Conversely, gradual compression from the lumbar spine to the thoracic spine on the convexity can aid in additional coronal correction. If necessary, in-situ benders can be used.

Once correction has been attained, final tighten all setscrews with the appropriate torque-limiting wrench.

Notes: Completely neutral axial plane alignment may not be achieved at the apex, especially in large, rigid curves.
Final Tightening

Final tightening of the outer setscrew is performed with the Dual Innies Final Tightener with Indicator and final tightening of the inner setscrew is performed with the X25 Final Tightener (per standard EXPEDIUM® final tightening techniques).

The shaft of the DI Final Tightener with Indicator is inserted through the Rod Stabilizer (anti-torque device) and into the castle-nut feature of the setscrew. The Rod Stabilizer is then slid down over the screw head and onto the rod (Figure 14).
• Rotate the T-Handle clockwise until the white guidelines align indicating that 8 Newton meters or 80 in-lb has been applied (Figure 15).

Final tightening of the inner setscrew is preformed with the Hexlobe Shaft inserted into the T-Handle Torque Wrench, set to 80 in-lb.

• The T-Handle is rotated clockwise until it clicks and resistance is no longer evident.

Once Final Tightening is complete, reduction tabs can be broken off using the Reduction Tab Remover.

See EXPEDIUM® Surgical Technique for more details on Final Tightening.

Notes: The final tightener for the outer setscrew does not “click”. There are markings on both sides of the tightener to indicate the proper amount of force to be used. Also, the outer setscrew can be “white-knuckle” tightened if preferred.
Additional Techniques and Uses

Lumbar Leveling & Converging Screws
Particularly in degenerative deformities and where the surgeon may wish to save mobile segments, it may be useful to compress or distract screws on the rod to level a vertebra. This can be achieved without losing vertebral derotation.

- Implant screws and use the notch to locate the side of the favored angle.

- Position screw head so that favored angle is medial, allowing for easier placement of rod and setscrew. Medial placement of the screw head will alleviate the struggle with soft tissue impeding on the converging screws in the lower lumbar spine.

- Capture and reduce the rod using the reduction tabs, leaving inner portion of setscrew loose.

- Ensure that outer portion of setscrew is locked, which will lock the trajectory of the screw shank, while allowing for true parallel compression or distraction of the vertebral level (Figure 16 & 17). This can be a useful maneuver to achieve a complete discectomy, in a transforaminal or posterior lumbar interbody fusion, to minimize the effect of intervertebral “fish-mouth” or to place uniform load on the subsequent bone graft.

- Next, compress or distract as needed and final tighten inner setscrew.
Proximal Overcontouring or Hyperkyphosis

If it is felt that hyperlordosis is being created and proximal junctional kyphosis is a concern, the rod can be overcontoured to allow for flattening after placement and correction (Figure 18 & 19).

Use the extended tabs to more easily capture the overcontoured rod into the screws.

The same maneuver can be used to reduce kyphosis by cantilevering the rods into the distal lumbar reduction screws.
**Pumphandle / Cantilever**

This maneuver is particularly useful for large and stiff curves and for kyphotic deformities. A CoCr Alloy rod may be used in place of titanium if increased rod stiffness is desirable.

- Place rod in proximal screws and tighten outer set screws to lock head in place.
- Cantilever rod into distal screws using rod holder. Extended tabs should allow for easy delivery of the rod to the screw (Figure 20 & 21).
- Place set screws in rest of screw heads to capture and lock rod into place.
Removal/Revision Instructions

Removal Procedure
If a decision is made to remove the implants after solid fusion occurs, the following steps should be taken after the implant is exposed:

1. Clean debris/tissue from the setscrew.
2. Loosen the setscrews and remove.
3. Remove the rod to expose the head of the screw. Perform necessary revision, if applicable.
4. Insert screwdriver into screw head and to back screw out of the pedicle.
# Ordering Information

## Implants

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## Instrument Cases / Trays

The following instruments, cases and trays are specific to the Favored Angle screw.

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INDICATIONS
The EXPEDİUM® Spine System is intended to provide immobilisation and stabilisation of spinal segments in skeletally mature patients as an adjunct to fusion in the treatment of acute and chronic instabilities or deformities of the thoracic, lumbar and sacral spine.

The EXPEDİUM® Spine System is intended for noncervical pedicle fixation and nonpedicle fixation for the following indications: degenerative disc disease (defined as back pain of discogenic origin with degeneration of the disc confirmed by history and radiographic studies); spondylolisthesis; trauma (i.e., fracture or dislocation); spinal stenosis; curvatures (i.e., scoliosis, kyphosis, and/or lordosis); tumour; pseudoarthrosis; and failed previous fusion in skeletally mature patients.

Limited Warranty and Disclaimer: DePuy Spine products are sold with a limited warranty to the original purchaser against defects in workmanship and materials. Any other express or implied warranties, including warranties of merchantability or fitness, are hereby disclaimed.